ATTACHMENT 1

MINIMUM GEOTECHNICAL REQUIREMENTS

460 CONNECTOR – PHASE I

0460-013-773 R201, C501, B628, B629, B630

April 24, 2008

(Revised March 27, 2009 - missing text added on page 17)

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Minimum Geotechnical Requirements For Access Roads

Construction of temporary or permanent access and/or haul roads, shall meet requirements for cut and fill slope design including the taking of adequate geotechnical borings and analyses to meet short and long term minimum safety factors included in the RFP. The investigation shall also be consistent with Chapter 3 of the VDOT Materials Manual of Instructions (MOI) that shall apply to all road types to include access and haul roads.

Minimum Geotechnical Requirements For Bridge Foundations

Investigate the bridge foundations areas and design foundations consistent with Chapter 3 of the VDOT Materials Manual of Instructions (MOI), AASHTO Standard Specification for the Design of Highway Bridges referenced in the RFP and with the following supplemental criteria:

- A minimum of four borings shall be drilled for each substructure unit for the Route 460 Connector Bridge (B628 & B629) site to determine subsurface conditions. Locations shall encapsulate the proposed foundation footprint. At least one boring shall be drilled for each substructure for the Route 80 Connector Bridge (B630) in addition to the borings already performed in this area for the purpose of the Geotechnical Engineering Data Report include in the RFP package. Boring depths and laboratory testing shall provide information required for analyses and development of foundations based on AASHTO requirements as well as for design of temporary shoring for construction and other requirements in the RFP.

- Borings for the 460 bridge foundations shall be evaluated for evidence of potential impacts from the Pine Mountain Thrust Fault. Borings for foundations between Station 61 and 66 shall be drilled to a sufficient depth in the fault footwall area to verify the extent of fault influence within or below the foundation influence area. The use of geophysical studies to supplement borings for these evaluations is encouraged.

- For proposed construction access or haul roads, adequate geotechnical borings, consistent with Chapter 3 of the VDOT Material Manual of Instructions (MOI), will be performed to insure that the cut and fill slopes for these roads meet the minimum factor of safety requirements for cut and fill slope stability included in the RFP.

- An evaluation and design that accounts for the long term effects of corrosion on any permanent installations including concrete footings, piles, casing and rock bolting, if left in place. Sulfate resistant concrete and other corrosion protection measures must be used where coal seams are located within excavations for foundations. Design for corrosion in accordance with AASHTO and VDOT requirements and other RFP provisions.

- Design foundations for allowable loads and related movements in accordance with applicable AASHTO and VDOT design requirements. Design of foundations and excavations shall consider rock defects and discontinuities and their effect, if any, on the short and long term stability of slopes above and below the foundations in accordance with criteria in the RFP.

- Design foundations for bridges on the U.S. 460 Connector and the Route 80 Connector that provide bearing on or in rock. Design foundations in the area impacted by the Pine Mountain Thrust Fault to carry loads below the fault limits or indicate using analyses based on borings and other available information that the structure loads can be carried without impacting the stability of the area and without causing unacceptable deformations. Provide a global factor of safety of at least 1.5 for the slope with foundation loads included.

Consider the impact of steeply dipping formations, voids, slickensides and gouge in evaluations at the fault area. For analyses, it is suggested that evaluations to determine strengths for intact and broken rock mass, discontinuities and in filled material (i.e; gouge) be based on methods described in references including: TRB Special Report 247, *Landslides, Investigation and Mitigation*, (1996); Bieniawski, Z.T., *Engineering Rock Mass Classifications*, John Wiley & Sons, N.Y. (1989), and Barton, N. and Bandis, S., *Review of Predictive Capabilities of JRC-JCS Model in Engineering Practice*; Rock Joints, Barton and Stephanasson eds, Balkema (1990), and on test results.

- Consider scour impacts for foundations in areas subject to scour.

- Foundation excavations shall be backfilled with durable rock fill at completion of construction unless specifically authorized otherwise by the Department.

- Use drilling of foundation borings, reconnaissance and local contact to determine the location and extent of mining if any, of the Hagy coal, the Lower Splash Dam Coal and the Upper Splash Dam Coal beneath all foundations, particularly those west of Grassy Creek. No coal seams of 6 inches or more in thickness should be left in place within 5 feet below planned foundations as defined in the RFP. If it is determined that the Hagy, the Lower Splash Dam and/or the Upper Splash Dam Coal seams have been mined and are below planned foundations, the voids shall be fully grouted in accordance with the RFP to eliminate risk of subsidence after construction is complete.

Minimum Geotechnical Requirements For Coal Undercut

Where coal is anticipated below pavement subgrades or foundations, the following minimum criteria shall be met:

- Undercut and remove coal seams at least 6 inches in thickness and underclay, if present, when the top of the seam is within 6-feet below roadway subgrade. Provide a transition at least 25 feet long from the point of maximum undercut to subgrade, install a 6-inch diameter perforated pipe to drain the undercut and backfill to subgrade with non-calcareous select granular material.

- Undercut and remove coal seams at least 6 inches in thickness and underclay, if present, when the top of the coal seam is within 5 feet below a proposed foundation elevation. Foundations bearing on rock with coal located more than 5 feet below the proposed foundation elevation shall be designed in accordance with VDOT and AASHTO requirements and shall consider the presence of any coal and underclay seams. Where coal is undercut, provide for the release and treatment, if necessary, of potential drainage from the coal seam and for potential corrosion impacts on structural concrete.

Minimum Geotechnical Requirements For Corrosion Protection for Foundations

Design and construction of structure foundations shall consider potential corrosion impacts by applying the following minimum criteria:

- Use Type II cement for all structure foundations and coat exterior surfaces buried below the finished ground surface with an approved mastic in accordance with the applicable ASTM Method, unless test results indicate otherwise to the satisfaction of the Department.

- Coat and seal the surface of coal and carbonaceous shale seams encountered in excavations for foundations with an approved liquid asphalt before backfilling.

- Design shoring and anchor systems used for excavation support, but which will remain in place after construction, for lifetime corrosion losses consistent with AASHTO and the RFP.

Minimum Geotechnical Requirements For Embankments

The following specific minimum requirements are included for embankments constructed on the project:

- Construct fills in accordance with Section 303 of the Specifications and Special Provisions for the project. Side hill fills shall be benched into rock as required by the Special Provisions and shall meet the minimum Factor of Safety stability requirements as defined in the RFP.

- Where consolidation settlement is anticipated in foundation soils testing and analyses shall be provided to indicate that 90% of the predicted settlement will be completed by the end of construction, that there are no negative impacts on drainage pipes and that the maximum differential settlement between bridge foundations, abutments and approaches is less than one inch. Settlement monitoring including settlement plates and surface monuments shall be included to verify estimated results versus actual performance.

- A minimum thickness of 3 feet of durable rock shall be placed at the base of all embankments and fills.

- Except when structural fill is required durable rock shall be use for all embankments within the bridge limits, for a distance of 50 feet beyond the bridge abutments, and for backfill of excavations for pier and abutment. A slope of 1H:1V perpendicular to centerline shall be used to transition from durable rock fill to soil or non-durable rock fill beyond the 50-foot limit. Where necessary, the maximum size of durable rock fill shall be reduced to allow piles or deep foundations to be installed through that material.

- Settlement monitoring monuments (SMM) and/or settlement monitoring plates (SMP) should be installed in areas of non-durable fill at the approaches to the proposed bridge structures and in other areas of deep fill and/or fills that overlie compressible subgrade materials. Both the SMM and SMP shall be monitored and evaluated by the DB geotechnical engineer before releasing for paving in accordance with Section 303.04h(i) of the Virginia Road and Bridge Specifications. The settlement monitoring monument (SMM) shall consist of at least a 3.5-foot long steel reinforcing rod (minimum No 5 diameter), meeting the requirements of VDOT Specification, Section 230, centered in a 6-inch diameter, 3-foot deep hole filled with Class 20 Cement Concrete, meeting the requirements of VDOT Specification, Section 217. The rod shall be installed so that one end is at the bottom of the hole and the other is a nominal 6 inches above the ground surface (or rough grade). Settlement monitoring plates (SMP) shall be installed in accordance with the requirements included in the Virginia Road and Bridge Specifications. At all times the SMMs and SMPs shall be marked or flagged adequately to prevent damage from construction equipment. Place a 3-foot high fluorescent, plastic mesh fence at a 2.5-foot radius around the SMMs and SMPs. In the event an SMM or SMPs are damaged or vandalized during construction operations or monitoring, replace materials to the extent necessary to accurately continue monitoring. At completion of monitoring, the SMMs and

SMPs shall be removed in accordance with the specifications. Based upon the current 30% plans and preliminary test boring data, the SMMs and SMP should be installed at the following minimum locations.

Rte 460

At least four SMMs shall be installed between Stations 66+50 and 70+00 within the proposed roadway shoulder of about 50 ft left of the centerline.

Rte 80

Two SMPs shall be installed at about Stations 20+50 and 21+50 which is in the area of the soft subgrade soils and existing fill denoted in the borings along with at least three SMMs between Stations 19+00 and 22+00 all at about 40 ft right of the centerline. At least three SMMs shall be installed within the embankment at the approaches to the bridge between Stations 25+00 and 28+00 all at 40 ft right of the centerline and between Stations 32+50 and 36+00 all at 40 ft left of the centerline.

Rte 609

At least three SMMs shall be installed on both sides of the embankment between Stations 14+50 and 16+50 at about 40 ft left and 40 ft right of the centerline and at least one SMP at Station 15+50 to about 40 ft left of the centerline.

- Maximum fill slopes for soil and/or non-durable rock will be 2H:1V. Slopes no steeper than 1.5H:1V meeting the minimum requirements in the RFP and having a minimum factor of safety of at least 1.50 may be considered in select areas of the project site when constructed entirely of durable rock.

Minimum Geotechnical Requirements For Grouting of Deep Mines

Deep mine workings encountered by geotechnical investigations shall be treated in the following manner:

- Deep mines and voids in overlying rock shall be completely filled with cementitious grout when encountered more than 5 feet below roadway grade but less than 50 feet below roadway grade.

- Deep mines and voids in overlying rock shall be completely filled with cementitious grout when encountered more than 5 feet below but less than 150 feet below structure foundations or retaining structures.

- Specific attention should be given to the verification of conditions in the Hagy, Upper and Lower Splash Dam and the Kennedy Coal Seams relative to the criteria for grouting.

- The lateral limit of grouting shall be established based on a line which is 15 degrees from vertical at the outside edge of shoulder, at the outside perimeter of the foundation or from the outside limit of the retaining wall.

- The grouting program shall be developed by an individual with at least 5 years experience in grouting, and the grouting shall be completed under their supervision with completion of QA/QC documentation for the operation.

Minimum Geotechnical Requirements For Mine Opening Backfill

Coal mine openings encountered in cut slopes shall be backfilled in the following manner

- If encountered between designed bench pattern, adjust bench elevations to top of coal seam or add bench if possible and if approved by VDOT.
- Place 2 – 6-inch diameter solid wall SCH 80 PVC pipes into the opening at least 5 feet beyond the limits of the sandstone backfill, described below, and at a maximum spacing along the face of the cut of 30 feet. Shape ground surface and set pipe to drain towards the cut face.
- Place a 6-inch diameter perforated SCH 80 PVC pipe along the face of the opening to collect water from the two 6-inch solid wall pipes inserted in the opening and any other seepage to beyond the limits of the mine opening. Extend the pipe as needed to discharge at a location that does not result in erosion of the slope. The pipe perforations shall be ½-inch diameter, at 4-inch spacing along the circumference of the pipe, and at a longitudinal spacing of 6-inches along the pipe. Some excavation may be needed to provide uniform bedding for the pipes and to achieve drainage away from the area.
- Provide No. 57 stone bedding for the bottom of the perforated pipe.
- Backfill the entry with well-graded sandstone pieces having a 6 to 12 inch maximum dimension, for the full height of the opening and horizontally at least 10 feet into the entry or to the depth of the entry, if less than 10 feet. Take care to place around pipes to provide adequate support.
- Grout the outer 12-inches of sandstone backfill with Hydraulic Cement Grout per Section 218 of the VDOT Standard Specification to lessen the potential for removal of the backfill. Do not allow the grout to interrupt solid or perforated drainage pipes.
- Cover the perforated pipe with a minimum 18 inches of sandstone backfill.
- The Design Builder will be responsible for the design of backfilling of all existing coal mines encountered in cut slopes. Therefore, any alternate methods for design and backfilling of the coal mines that differ from these minimum requirements based on conditions encountered during final design investigations or during construction shall require approval by the Department.

Minimum Geotechnical Requirements For Soil Cut and Fill Slopes

Soil cut and fill slopes shall be designed in accordance with the following requirements:

- Construct all soil cut slopes no steeper than 2H:1V. Slopes no steeper than 1.5H:1V that meet the minimum factor of safety requirements indicated below may be considered in select areas of the project site as described herein.

- A 1.5H:1V cut slope with a minimum 10-foot wide soil-rock transition bench may be considered in select areas of the site; however, the areas where steeper slopes are to be constructed must be approved by the Department and meet the minimum factors of safety indicated herein.

- The following factors of safety shall be used with limit equilibrium methods of analysis to determine factors of safety for representative sections for design of all soil cut and soil embankment fill slope and/or where slopes are supporting on, or are supported by, retaining structures. The factors of safety listed in Table 1 below are valid for subsurface investigations performed in accordance with Chapter III of the Materials Division's Manual of Instructions or for site specific investigation plans approved by the District Materials Engineer. Approval of site specific investigation plans with reduced boring frequency may require higher factors of safety. Table 1 is not applicable for rock cut slopes.

Table 1: Minimum Factors of Safety for Soil Cut/Fill Slopes

Slope analysis parameters based on:	Factor of Safety	
	Involves Structure or Critical Slope[1]	Non-Critical Slope
In-situ or lab. tests and measurements[2,3]	1.5	1.3
No site specific tests	N/A[3]	1.5

1. A critical slope is defined as any slope that is greater than 25' in height, affects or supports a structure, or whose failure would result in significant cost for repair, or damage to, private property
2. Site specific in-situ tests include both groundwater measurements and SPT testing but may also include CPT or DMT
3. Parameters for critical slopes involving structures must be based on specific laboratory testing
4. Problem soils (very soft soils, very loose soils, or heavily over-consolidated soils), must be analyzed using shear strength parameters determined from appropriate laboratory strength tests
5. Minimum requirements for soil types consistent with the parameters used in slope analyses must be specified on the construction plans

- Determine locations where ground water seepage in the finished cut slope is anticipated and provide slope surface treatments to stabilize the condition.

Minimum Geotechnical Requirements For Soil Rock Transition Subgrades

Subgrade transitions shall be provided in the following manner where subgrade conditions change from soil to rock as required herein:

- Over-excavated rock to a depth of 4-feet. The remainder of the over-excavation shall be sloped to meet subgrade at a horizontal distance of 50-feet.

- At the low point, excavate a minimum 1-foot wide trench drain, install a 6-inch diameter perforated underdrain pipe and backfill the trench backfilled with No. 57 aggregate in accordance with VDOT Standards. The drain shall be connected to an outlet pipe.

- The bottom 12-inches of the over-excavation shall be backfilled with No. 57 aggregate encapsulated with a geotextile in accordance with VDOT Standards.

- The remainder of the over-excavation shall be backfilled with Subbase Material.

Minimum Geotechnical Requirements For Surplus Disposal Area

The location of a Surplus Materials Area has been provided in the plans. Design and construction of this area shall meet the following minimum requirements and as defined in the RFP:

- Review available information and obtain an adequate number of supplemental borings to define subsurface conditions for the development design parameters.

- Design the Surplus Materials Area to provide a minimum factor of safety of 1.3 as defined in the RFP for soil and rock fills. Analysis shall be consistent with the Plan for Grading in this area.

- Provide a Plan for Grading of the area which includes plans and sections and a stepwise description detailing the sequence of earthwork operations including preparation of the existing ground, locations where various materials (suitable and unsuitable) will be placed and compaction control for placement of materials in addition to the other requirements the special provisions.

- Incorporate documentation verifying implementation of the Plan for Grading into the QA/QC Plans.

- Incorporate provision for drainage and treatment of existing ground including abandoned coal mines in this area, to provide long term control of seepage and stability for the Surplus Materials Area.

- All applicable requirements included in the Road and Bridge Specification for off site disposal in Section 106.04 apply to the designated Surplus Materials Area and are supplemented to these requirements.

Minimum Geotechnical Requirements For Retaining Walls

Retaining wall structures shall be designed in accordance with the follow requirements:

- The maximum height of retaining walls on this project shall be limited to 50 feet as measured from the base of the leveling pad or footing to the top of the wall and includes any height in front of the wall which may be backfilled.

- Design retaining walls in accordance with VDOT and AASHTO requirements.

- If the design-builder elects to use mechanically stabilized earth (MSE) walls, the fill material used in the reinforced zone shall be a crushed aggregate with properties in accordance with VDOT's special provisions for approved proprietary MSE wall(s). If MSE wall(s) are used at abutments for the Bridges over Grassy Creek and Route 610, fill benching must be of sufficient width to accommodate the required MSE strap lengths.

- Provide global stability and control settlement within tolerances identified in the RFP for any retaining structures used on the project.

- In addition to any other related requirements in the RFP, the finished ground surface where it meets a retaining wall shall include a minimum 5-foot wide bench sloping at 20H:1V away from the wall.

Minimum Geotechnical Requirements For Rock Cut Slopes

Design cut slopes in bedrock shall satisfy the following procedures and minimum requirements:

- Review Existing Geologic Information: - The designer shall review all available geologic information including published and unpublished geologic information and previously prepared geotechnical reports

- Perform a Field Reconnaissance – Perform a site reconnaissance that includes but is not limited to logging of rock exposures in and around the project area, measurement of the orientation and condition of joints and other discontinuities in exposures and observation of the performance of existing cut slopes in the same rock units expected to be encountered in the project stratigraphy.

- Perform the Final Design Subsurface Investigation: The designer shall develop a subsurface investigation program to supplement available, previously drilled borings at intervals no greater than specified in Chapter 3 of VDOT's Material Manual of Instructions (MOI). In additional, borings shall be performed at the beginning and end of cuts to design for transitions in rock quality and changes from rock to soil cut. In addition to procedures in the MOI, Rock Quality Designation (RQD) shall be measured and reported for each core run and for each Stratum (SRQD).where the length of all the RQD rock within a stratum is divided by the thickness of the stratum.

- Develop Geologic Profile: The designer shall develop a geologic profile(s) for the roadway alignment(s). This profile shall include both previous and new borings and be used to define and thoroughly characterize the stratigraphy and lithology of each rock units in each cut.

- Laboratory Testing: The designer shall conduct laboratory testing on rock core samples consisting, at a minimum of Slake Durability Index (SDI) and unconfined compressive strength testing (UCS) for the development of design parameters. The SDI value shall be determined for 2 and 5 cycles. The number of each test shall be determined based on the number of rock units encountered in each cut. The minimum number of each test shall be one test per rock unit for every 500 feet of alignment length.

- Rock Cut Minimum Slope Criteria: The following table shall be used to determine the configuration of the rock cut slopes with the noted exceptions:

Minimum Slope Design Criteria for Rock Cut Slopes
US460 Connector
(For rock with 5-cycle SDI > 50 % and Type I or II Fragments[1])

Bedrock Category	SRQD (%)	UCS (psi)	Slope[1,4] Ratio (H:V)	Max Height Between Benches[3] (ft)
A	>70	> 5,000 3,000-5,000 <3,000	1/2H:1V[2] 1/2H:1V 1H:1V	40
B	51–70	>5,000 3,000 – 5,000 <3,000	1/2H:1V 1/2H:1V 1H:1V	40
C	20-50	> 5,000 3,000-5,000 <3,000	1/2H:1V 1H:1V 1H:1V	40
D	<20%	NA	1.5H:1V	NA

Notes:
[1] For rock units with a 5-cycle SDI <50% and/or Type III fragments, use 1.5H:1V unless proven history of past performance indicates steeper slope is acceptable and if approved by the Department.
[2] May use 1/4H:1V for sandstone.
[3] Within the same lithologic unit
[4] Represents the minimum allowable slope ratio for all rock cut slopes. The Designer shall perform the required analysis based upon the criteria outlined herein to determine if a flatter slope is required to achieve adequate stability of the cut slope.

- Cut Slope Benches: The designer shall include cut slope benches at the following locations:

  - Lithologic Bench – At the base of sandstone units, which are underlain by shale, claystone, clayshale or coal units. Also at the base of rock units which are underlain by units having lower SDI values.

  - Soil/Rock Transitions Bench - At the soil/bedrock interface at the top of cut unless approved otherwise by the Department.

  - Maximum Interval Bench - At maximum intervals indicated in the above Table.

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Lithologic and Maximum Interval Benches shall have a minimum width of 15 feet and Soil/Rock Transition Benches shall have minimum width of 10 feet. All benches shall be sloped toward the roadway at a slope 15H:1V to 20H:1V.

- Rockfall Containment Ditch: The designer shall include a rockfall containment ditch at road level. This ditch will be designed using either the "Ritchie Ditch" (Ritchie, 1963) or the "Oregon Ditch" (Pierson et al, 2001) criteria. The ditch shall be designed to drain and prevent ponding of water. Rock fall fence barriers, drapped fencing or other rockfall control methods of any kind will not be allowed.

- Develop Geologic Cross-Sections: The designer shall develop cross-sections showing the geologic and proposed cut configuration at a minimum of 50 foot intervals along the alignment to verify the effectiveness of the design. Changes and transitions in slope configurations and ratios based on design borings and field observations should be smooth rather than rapid and frequent where variations between borings are obtained.

- Develop Cut Plan View - The Designer shall develop a plan view of the proposed cut configuration to assess its effectiveness and impacts from drainageways as indicated below.

- Evaluation of Potential Rockfall: The Colorado Rockfall Simulation Program (CRSP) or an equivalent program, approved by the Department shall be used to model the proposed rock cut slope configuration to evaluate the effectiveness of the containment ditch in preventing rockfalls from reaching the roadway. The analyses shall include a model representing the completed slope at the end of construction and a model representing long term slope conditions with weathering impacts, such as loss of bench width and/or talus build-up on benches. The proposed cut slope and containment ditch shall prevent rock fall from reaching the roadway shoulder.

- Evaluation of Discontinuities: The designer shall measure and evaluate the condition and orientation of bedrock discontinuities in the proposed rock cut slopes. The discontinuity information shall be used to analyze the risk of block, wedge, or toppling failures in the proposed rock cut slope. The designer shall use the results of the analyses and consider if slopes flatter than those in the table of Slope Design Criteria are warranted to reduce the potential for failures.

- Drainage Gullys: The designer shall review proposed cut slope areas for existing drainageways that will be intersected by the cut causing water to be discharged over the face of the slope, increasing the potential for rockfalls and erosion of the slope. In these areas, where rock has an SDI of less than 90%, slopes shall be flattened or permanent slope protection installed to prevent erosion and undercutting.

- Blasting Control: When explosives are used in excavation of rock cuts, the pre-split blasting technique defined in Section 303.04a of the Virginia Road and Bridge Specification (2002) shall be used except for fill bench construction and where slopes flatter than 1H:1V is designed . The Design-Builder shall include as part of the design team a blasting consultant, approved by the Department, with a minimum of 5 years

experience developing blasting plans and providing oversite of blasting operations on highway projects in rock having the same geologic lithology. A resume to include qualifications and relevant experience of the person responsible for review of blasting plans and oversight of blasting operations shall be submitted to the Department for approval before review and approval of the blasting plans. The consultant shall review the blasting plans used by the blasting contractor to verify it includes the results of blasting on a test section. The consultant shall make regular visits to the site as excavation progresses to verify that the plan need not be modified. The Design Build Contractor may utilize an in-house blasting expert to perform the role of the blasting consultant providing they meet the same minimum requirements as the blasting consultant noted above, have been approved by the Department and are not directly involved in the development of the blasting plans. Finished slopes shall be scaled to remove loose rock pieces as required by the specification.

- Coordination and QA/QC Review by Project Geotechnical Engineer - The design geotechnical engineering firm shall designate an experienced geotechnical engineer or geologist who will be on-site during excavations or visit the site at regular intervals during construction to perform a QA/QC review of slope excavation operations and verify the planned slope design is suitable or make modifications if necessary.

Minimum Geotechnical Requirements For Storm Water Management Basins

Design Storm Water Management (SWM) Basins shall be in accordance with the RFP and the following requirements:

- Design of storm water management ponds shall meet criteria for stability of cut and fill slopes in the RFP.

- A geomembrane liner shall be installed over the inside of each SWM basin

- SWM basins that are to be located in the area beneath the proposed bridge structures, but not on the slopes in the area of the Pine Mountain Fault (approx Station 61 to 66) shall be constructed using earthen dikes without permanent excavation below the existing ground surface. This requirement applies to any other areas where a SWM basin may be constructed beyond (Right or Left of) the bridge structures at the toe of a slope located in the area of the Fault. The maximum height of the dike shall be determined based on stability analysis that meets a minimum factor of safety of 1.5.

- Where ground conditions and grading indicate potential seepage into the foundation area of the dike, as from coal seams, incorporate provisions to collect and divert seepage around the basin unless otherwise approved by VDOT.

Minimum Geotechnical Requirements For Termini for the 460 Connector Bridge (Bridges B628 & B629)

The following requirements shall be applied to Bridges B628 and B629 over Grassy Creek and Route 610:

- The bridge limits, defined as the back face of the abutment backwall, shall not be located east of 49+25 for the west abutment, nor to the west of 66+00 for the east abutment.

- The front face of any MSE retaining walls or the limit of any wall substructure elements for abutments shall not be any more than 10 feet from the bridge limits, (i.e.; Station 49+35 and 65+90), unless approved by the Department.

- The maximum depth of new fill allowed at abutments is 10 feet, measured from the existing ground line in that area and no other new fill may be placed on the slopes within the bridge limits except as related to this requirement.